BIOLOGY 205 **Name _____**
FINAL EXAM - 09 December 2005

Multiple choice questions – 4 points each (single best answer for each).

1. A cell is composed of compounds that include proteins, nucleic acids, lipids, and carbohydrates. A cell is capable of reproduction, but when the compounds of the cell are isolated, none of them can reproduce. Therefore, cell reproduction is an example of ...

A. Growth
B. A molecule
C. An emergent property
D. Adaptation
E. Metabolism

2. Louis Pasteur designed an experiment using the swan-necked flask to prove that:

A. Bacterial organisms cannot be killed by heat
B. Life does not arise spontaneously from nonliving matter
C. Earth was really much older than people of the time thought
D. The half-life of uranium^{238} is 10 billion years
E. Maggots grow in meat

3. Ribosomes are a collection of:

A. small proteins that function in translation
B. proteins and rRNAs that function in translation
C. proteins and tRNAs that function in transcription
D. proteins and mRNAs that function in translation
E. mRNAs and tRNAs that function in translation

4. Imagine that a novel life form is found deep within Europa's Ocean. Evaluation of its DNA yields no surprises. However, it is found that a codon for this life form is just two bases in length. How many different amino acids maximum could this organism be composed of?

A. 4
B. 8
C. 16
D. 32
E. 64

5. One of the following biologically important macromolecules is NOT a polymer in the same sense as the other three, which molecule is it?

A. Nucleic acids
B. Proteins
C. Lipids
D. Polysaccharides

6. In sugar cane (a C_4 plant), CO_2 is released for use in the Calvin-Benson cycle:

A. In the bundle sheath cells.
B. During the evening.
C. In glucose molecules.
D. In the stroma.
E. None of the above.

7. The reduction of pyruvate to lactic acid during fermentation allows glycolysis to continue in the absence of oxygen. Why?

A. This reaction is coupled to the electron transport system
B. This reaction is coupled to the oxidation of $FADH_2$ to FAD^+
C. This reaction is coupled to the oxidation of $NADH + H^+$ to NAD^+
D. This reaction is coupled to the formation of ATP
E. This reaction is coupled to the reduction of NAD^+ to $NADH + H^+$

8. The microtubules of the mitotic spindle attach to a specialized structure in the centromere region of each chromosome, called the:

A. Kinetochore
B. Nucleosome
C. Equatorial plate
D. Aster
E. Centrosome

9. The enzyme that charges the tRNA molecules with appropriate amino acids and thereby acts as the universal code translator is:

A. tRNA isomerase
B. amino-tRNA chargeatase
C. reverse transcriptase
D. aminoacyl-tRNA synthetase
E. tRNA primase

10. Which of the following energy and/or electron carrier molecules is NOT derived from one or more nucleotides?

A. $FADH_2$
B. $NADH+H^+$
C. Coenzyme A
D. ATP
E. Chlorophyll a

11. In eukaryotic cells, where are proteins that eventually contain covalently attached sugar residues translated?

A. In the nucleus
B. On the Golgi apparatus
C. In the mitochondria
D. On the endoplasmic reticulum
E. In the cytoplasm

12. The universal genetic code is best described as:

A. degenerate but not ambiguous
B. ambiguous but not redundant
C. both ambiguous and redundant
D. neither ambiguous nor redundant
E. missense but not nonsense

13. The term auxotroph refers to:

A. a mutant form of a bacteria that requires nutrient(s) not required by the wild-type bacteria
B. a mutant form of a bacteria that requires no nutrients
C. a mutant form of a bacteria that can synthesize a nutrient which the wild-type bacteria cannot
D. a mutant form of a bacteria that can metabolize a nutrient which the wild-type bacteria cannot
E. a bacteria that can metabolize sugars

14. Which of the following is NOT a specific special property of **water**?

A. cohesive strength
B. adhesive strength
C. high heat capacity
D. more viscous to a whale than a bacterium
E. solid phase less dense that liquid

15. Of the following, which organelle and/or structure is NOT part of the **endomembrane system**?

A. nuclear envelope
B. endoplasmic reticulum
C. peroxisome
D. golgi apparatus
E. lysosome

16. How many moles of ATP are generated for each mole of acetyl-CoA introduced into the citric acid cycle strictly by substrate-level phosphorylation?

A. 1
B. 2
C. 3
D. 4
E. 6

17. **Microtubules** provide an avenue for the movement of organelles within the cell. Which of the following is the "motor" protein that provides the mechanism for this movement towards the positive end?

A. Kinesin
B. Dynein
C. Actin
D. Myosin
E. Keratin

18. When comparing the different levels of protein structure, which is/are best described by the occurrence of **β-pleated sheets**?

A. primary
B. secondary
C. tertiary
D. quaternary
E. all of the above

19. All of the following are types of chemical bonds. Which of these is capable of the strongest attractive force linking atoms together?

A. van der Waals attractions
B. Hydrogen bonds
C. Ionic bonds
D. Covalent bonds
E. Organic bonds

20. During replication, the new DNA strand is synthesized...

A. in the 3' to 5' direction
B. in the 5' to 3' direction
C. in both the 3' to 5' and 5' to 3' directions from the replication fork
D. from one end to the other, in the 3' to 5' or the 5' to 3' directions
E. None of the above

21. Which of the following features summarizes the molecular architecture of DNA?

A. The two strands run in opposite directions
B. The molecule twists in the same direction as the threads of most screws
C. The molecule is a double-stranded helix
D. DNA has a uniform diameter
E. All of the above

22. The energy necessary for making a DNA molecule comes directly from the...

A. sugar
B. ATP
C. release of phosphates
D. NADPH
E. NADH

23. The enzyme that removes the RNA primers is called...

A. DNA ligase
B. primase
C. reverse transcriptase
D. helicase
E. DNA polymerase I

24. When carbon dioxide is added to RuBP, the first stable product synthesized is:

A. Pyruvate
B. Glyceraldehyde 3-phosphate
C. 3-phosphoglycerate
D. ATP
E. None of the above

25. To obtain free energy, chemoautotrophs require a source of?

A. Reduced organic compounds
B. Reduced inorganic substances
C. Carbon dioxide
D. Light energy
E. Water

26. Biological membranes are composed of?

A. nucleotides and nucleosides
B. enzymes, electron acceptors, and electron donors
C. fatty acids
D. monosaccharides
E. lipids, proteins, and carbohydrates

27. When a plant cell is placed in a hypotonic solution, which of the following occurs?

A. The cell takes up water until the osmotic potential equals the pressure potential of the cell wall
B. The cell takes up water and eventually bursts
C. The cell shrinks away from the cell wall
D. There is no movement of water into or out of the cell
E. Water moves out of the cell

28. In the first reaction of glycolysis, glucose receives a phosphate group from ATP. This reaction is...

A. Respiration
B. A redox reaction
C. Exergonic
D. Endergonic
E. Fermentation

29. Animals inhale air-containing oxygen and exhale air with less oxygen and more carbon dioxide. Later, the oxygen from the air will most likely be found in....

A. The carbon dioxide that is exhaled
B. Water
C. Organic molecules
D. Ethanol
E. Lactate

30. In cyclic photophosphorylation, chlorophyll is reduced by which of the following?

A. ATP
B. $NADPH + H^+$
C. Ferredoxin
D. Plastocyanin
E. Hydrogens liberated by the splitting of a water molecule

31. In noncyclic photophosphorylation, electrons from which source replenish chlorophyll molecules that have given up electrons?

A. Carbon Dioxide
B. Water
C. $NADPH + H^+$
D. Oxygen
E. ATP

32. Structures that contain networks of keratin fibers and hold adjacent cells together are called:

A. Extracellular matrices
B. Glycoproteins
C. Gap junctions
D. Desmosomes
E. Phospholipid bilayers

Matching Questions - 3 points each. Indicate if the following reactions occur in photosynthesis only (**A**); respiration only (**B**); or both photosynthesis and respiration **(C**).

33. _____ ATP synthesis by chemiosmosis

34. _____ reduction of $NADP^+$

35. _____ electron flow along a cytochrome chain (ETC)

36. _____ substrate level phosphorylation

37. _____ oxidation of water

More Matching – 3 points each. Use single best answer to match the organelle with the characteristic/process that is best described or associated with it. The possible answers are: **A.** Ribosomes, **B.** Mitochondria, **C.** Lysosome, **D.** Nucleus, and **E.** Chloroplast.

38. _____ Apoptosis

39. _____ Translation

40. _____ DNA synthesis

41. _____ RuBisCo

42. _____ DNA replication

43. _____ Phagocytosis

44. _____ Thylakoid membrane

45. _____ Transcription

46. _____ Matrix

47. _____ RNA processing

More Matching – 3 points each. Match the proper catabolic stage of glucose catabolism. The possible answers are **(A)** Glycolysis, **(B)** Oxidation of Pyruvate to Acetyl CoA, **(C)** Citric Acid Cycle; **(D)** Oxidative Phosphorylation, **(E)** Respiratory or Electron Transport Chain.

48. _____ At which stage does NAD^+ first get reduced to $NADH + H^+$?

49. _____ At which stage is the carbon skeleton of glucose split?

50. _____ At which stage do hydrogen ions (i.e., protons) diffuse down a gradient?

51. _____ At which stage in aerobic respiration is the first molecule of CO_2 produced?

52. _____ At which stage does FAD^+ first get reduced to $FADH_2$?

Short answer – Number of points in parentheses.

53. **(6 points)** Name **two** different pathways that each contain steps where a particular molecule gets **two** phosphate groups attached **AND** describe which step within each pathway where this occurs. **Finally**, describe why these steps are most critical to the functioning of each pathway.

54. **(6 points)** Consider the "idealized" cell. Starting on the outside of an animal cell and moving to the matrix of a mitochondrion, how many membranes would you have to cross AND what are each of their names?

55. **Extra Credit (6 points)** What are three specific mechanisms (<u>AND when do these occur</u>) for introducing genetic variation from one generation to the next in sexually reproducing organisms?